

***Microwave Fuze***

**INNOVATIVE DIGITAL PROXIMITY FUZE  
FOR 76/62 mm GUN  
(Microwave, Programmable)**



*Companies*



**SIMMEL DIFESA**

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*Authors*

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45th Fuze Conference, Long Beach, CA, April 16-18 2001

**Microwave Fuze**

# ITALIAN NAVY

awarded the development contract

ALENIA DIFESA

OTOBREDA DIV.

(former OTO Melara)

- computer modeling
- $\mu$ W sensor
- signal processor
- firing tests

 OtoBreda Division

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DIFESA

SIMMEL DIFESA SpA

(heritage from Borletti and BPD)

- fuze integration
- impact sensor
- post-impact delay
- battery
- S&A
- pyrotechnic chain



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## FUZE MAJOR FEATURES

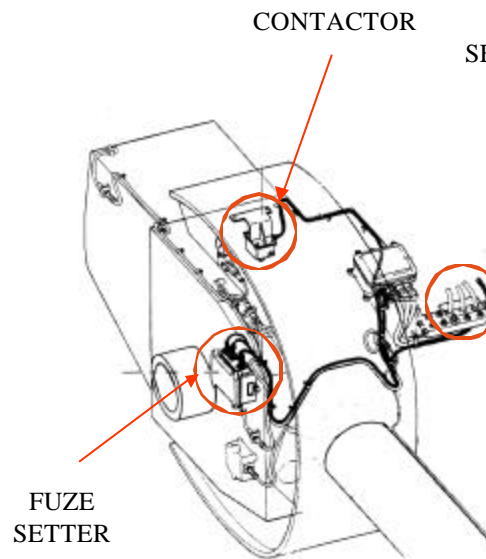
- PROGRAMMABILITY OF OPERATING MODES  
from the FCS through a setter
- 5 OPERATING MODES
  - PROXIMITY vs SEA SKIMMER (default mode)
  - PROXIMITY vs FIXED WING AIRCRAFT
  - PROXIMITY vs ROTARY WING AIRCRAFT
  - PROXIMITY vs SURFACE TARGETS
  - DELAYED IMPACT vs REINFORCED TARGETS
- 2 BACK-UP MODES (not available if delayed impact is selected)
  - UNDELAYED IMPACT
  - SELF DESTRUCTION

## FUZE MAJOR FEATURES continued

- SAFETY SYSTEM
  - COMPLIANT WITH STANAG 4187
  - SAFE SEPARATION DISTANCE (MECHANICAL ARMING) > 100 m
- OPERATING TEMPERATURE RANGE  $-31^{\circ}\text{C} \div +63^{\circ}\text{C}$
- STORAGE TEMPERATURE RANGE  $-40^{\circ}\text{C} \div +71^{\circ}\text{C}$

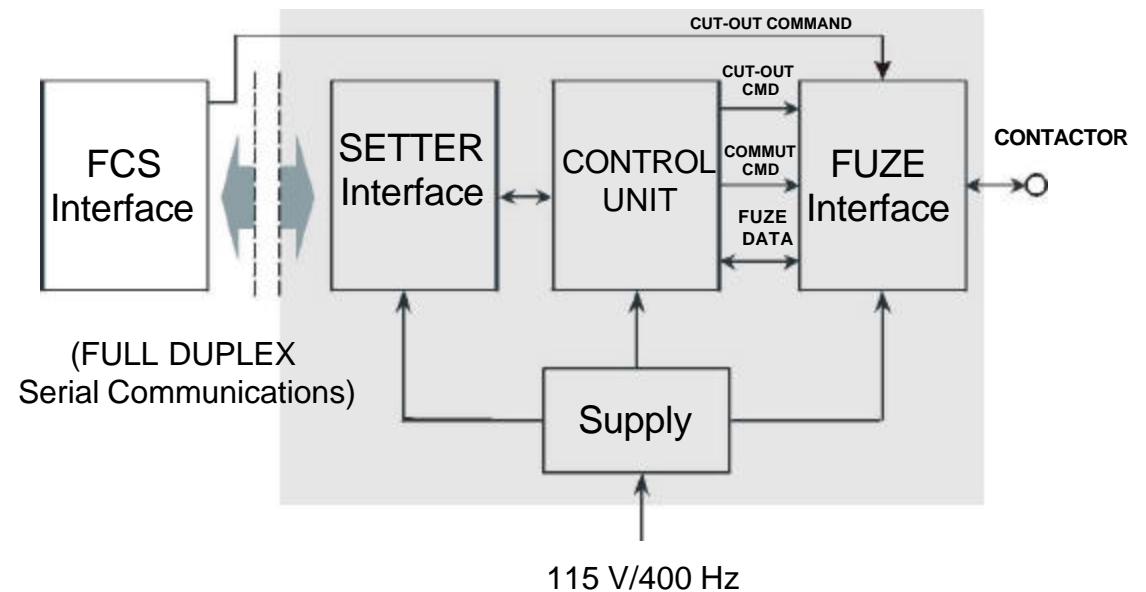
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# ELECTRONIC SETTING SYSTEM FOR 76 mm PROXIMITY FUZE



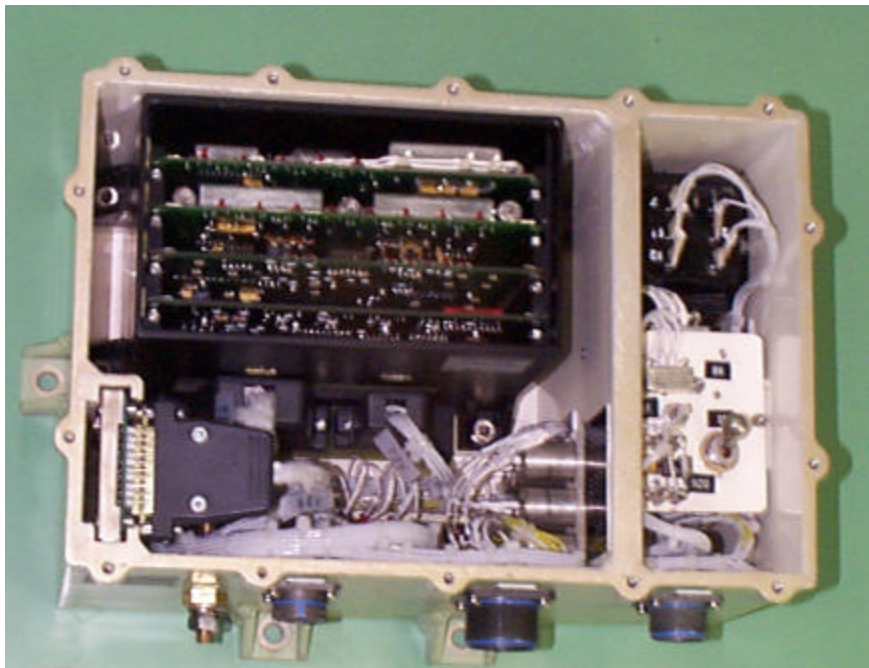
## INSTALLATION ON GUN ELEVATING MASS

## FUNCTIONAL BLOCK DIAGRAM



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## ELECTRONIC SETTER FOR 76 mm PROXIMITY FUZE



- DEVELOPMENT COMPLETED
- 4 SYSTEMS ORDERED BY ITALIAN NAVY FOR NEW FPB's
- 18 SYSTEMS WILL BE INSTALLED ON EXISTING SHIPS

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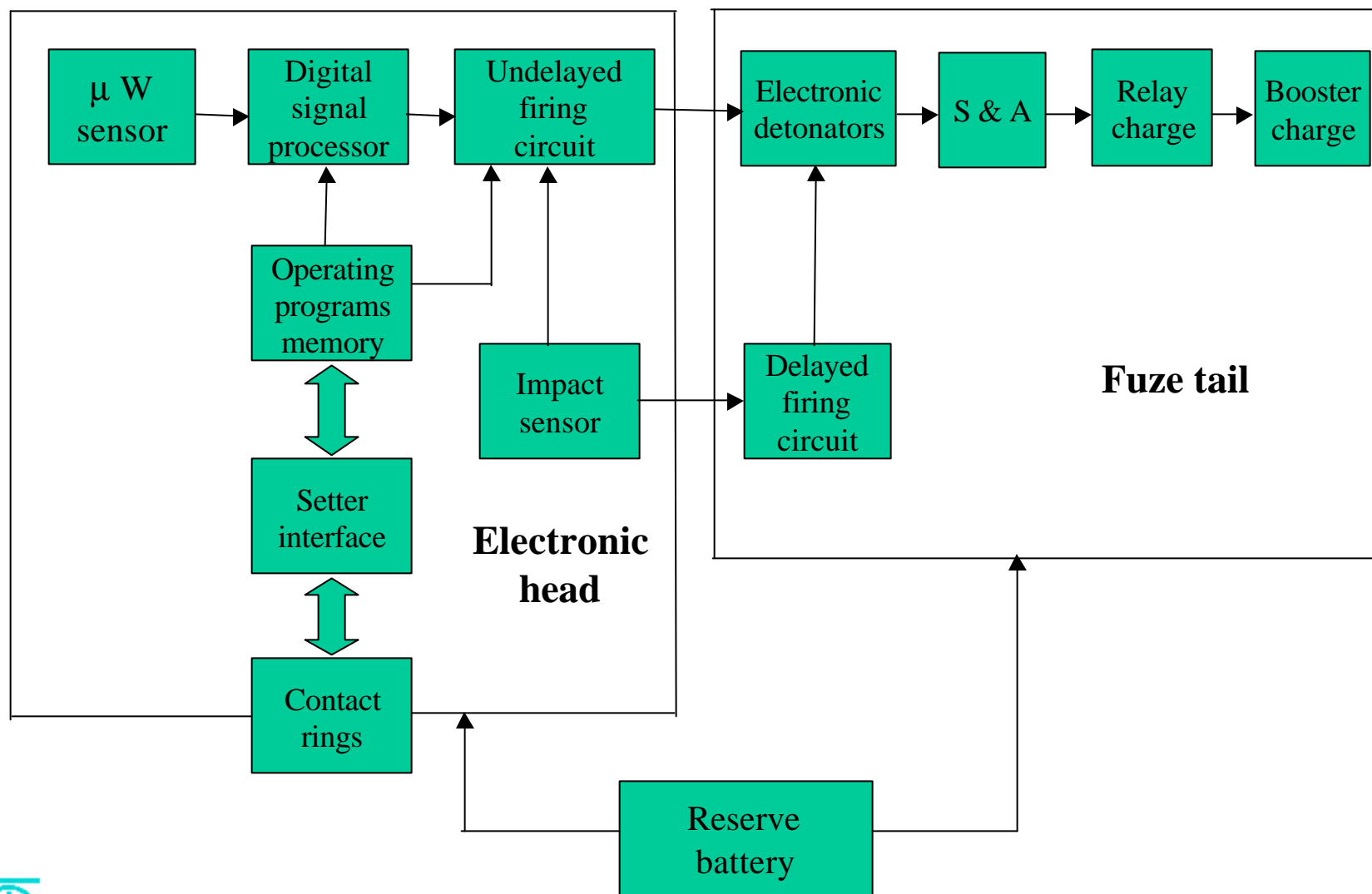
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## **ELECTRONIC SETTER FOR 76 mm PROXIMITY FUZE**

### **FUNCTIONS**

- **SELECT THE OPERATING MODE (PROXIMITY/DELAYED IMPACT).**
- **ENABLE FUZE RECEIVER JUST BEFORE TARGET INTERCEPT.**
- **OPTIMIZE PROXIMITY PERFORMANCE AGAINST DIFFERENT KINDS OF TARGETS BY SELECTING DEDICATED SOFTWARE.**
- **RETAIN THE COMPATIBILITY WITH IN-SERVICE FUZES**

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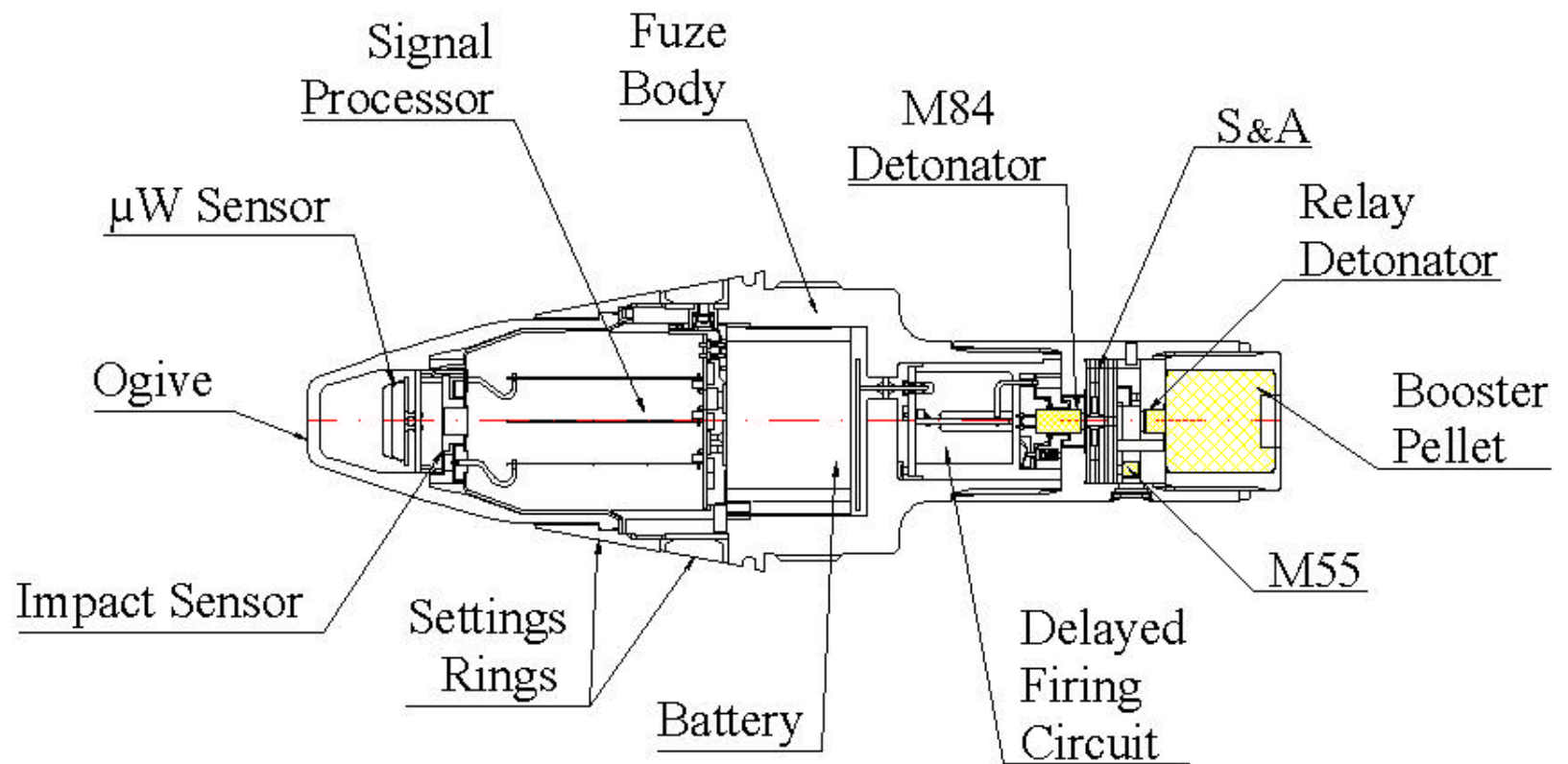


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# Fuze layout



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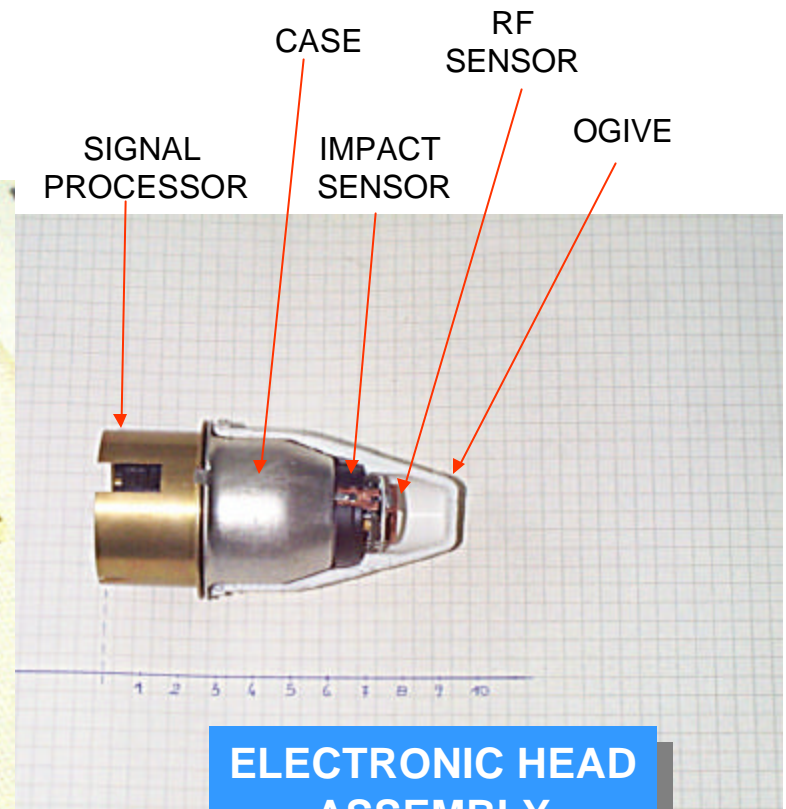
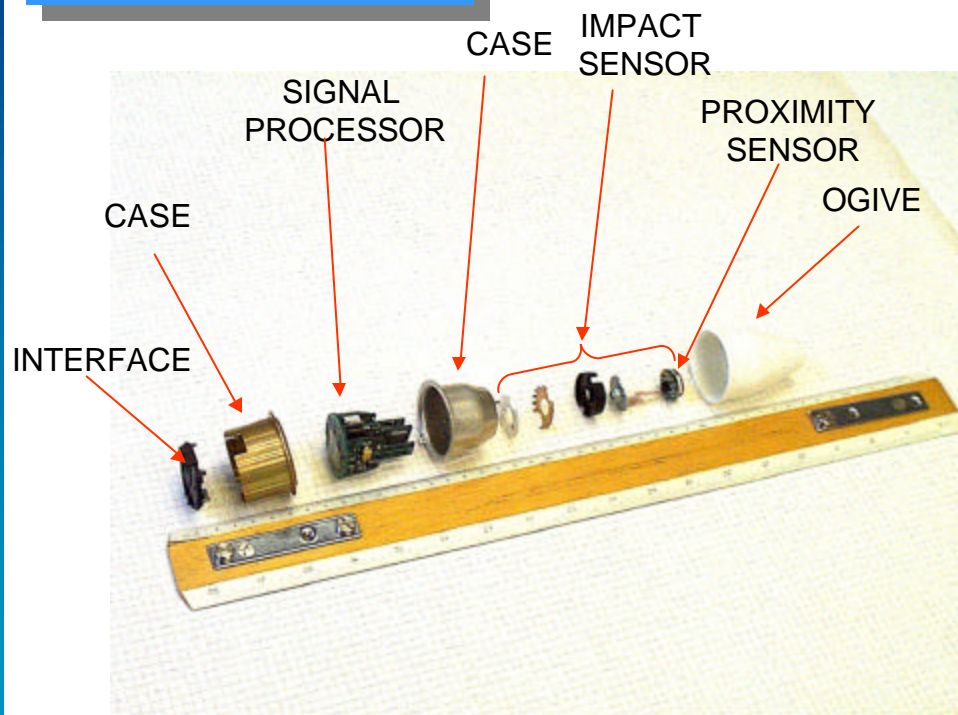
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## FUZE TECHNICAL DESCRIPTION

### ELECTRONIC HEAD BREAKDOWN



### ELECTRONIC HEAD ASSEMBLY

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## TELEMETRY PROJECTILE FOR IN FLIGHT TEST

USED DURING FUZE DEVELOPMENT



FUZE UNDER TEST

TELEMETRY  
EQUIPMENT

- 2 A.C. CHANNELS FOR SENSORS SIGNALS (WIDEBAND)
- 2 D. C. CHANNELS FOR POWER SUPPLY CHECK
- 1 TRIGGER CHANNEL FOR DETONATION CHECK

TELEMETRY  
ANTENNA

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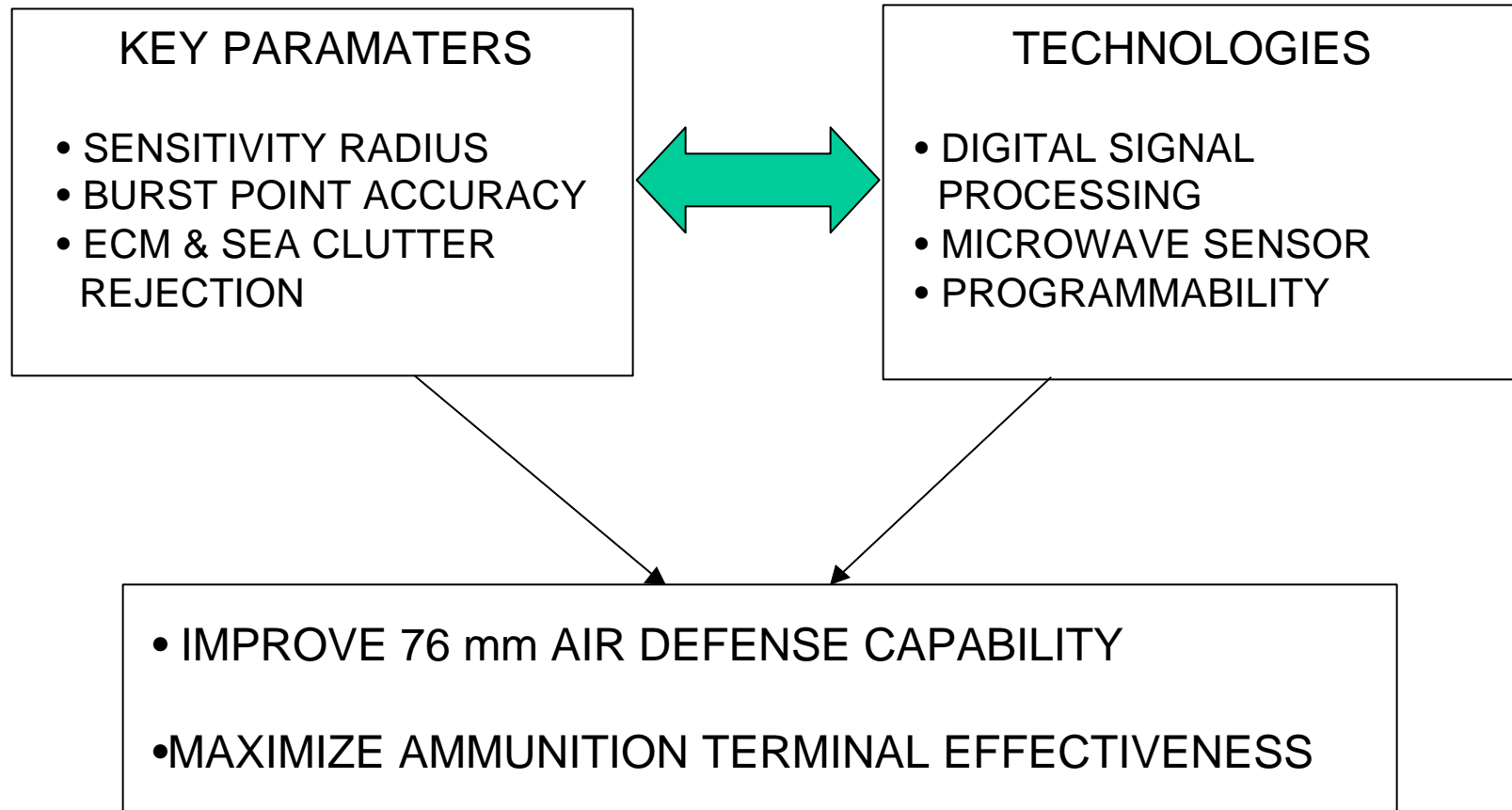
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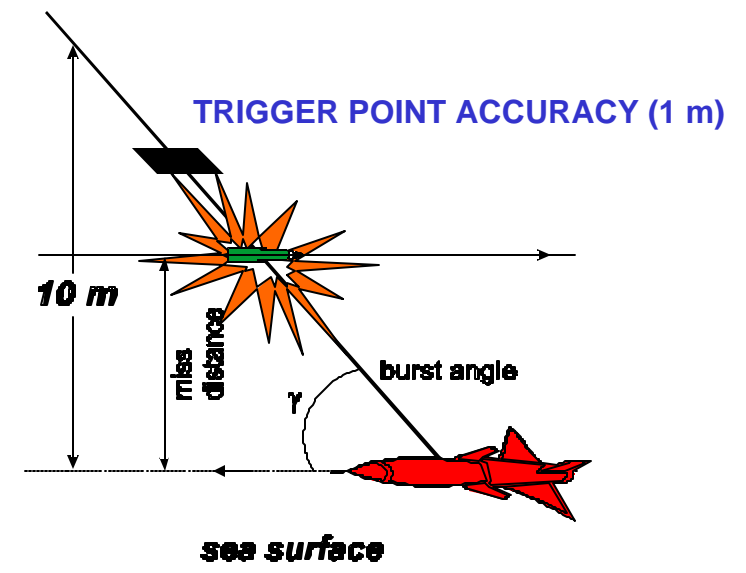
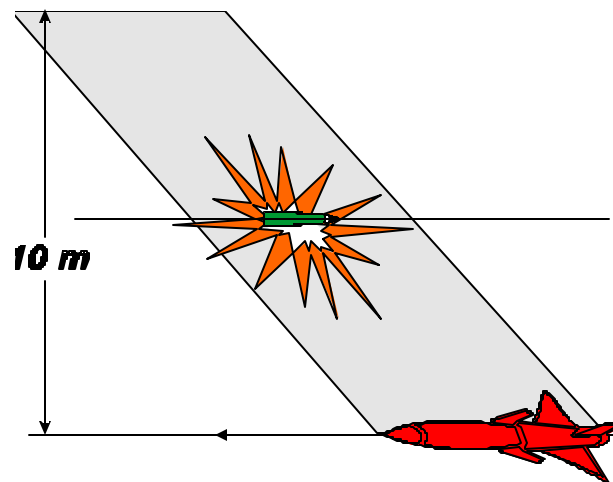


## WHY A NEW FUZE



# CHARACTERISTICS OF THE NEW MICROWAVE FUZE

USEFUL BURST ZONE  
FOR AMMUNITION TERMINAL EFFECTIVENESS

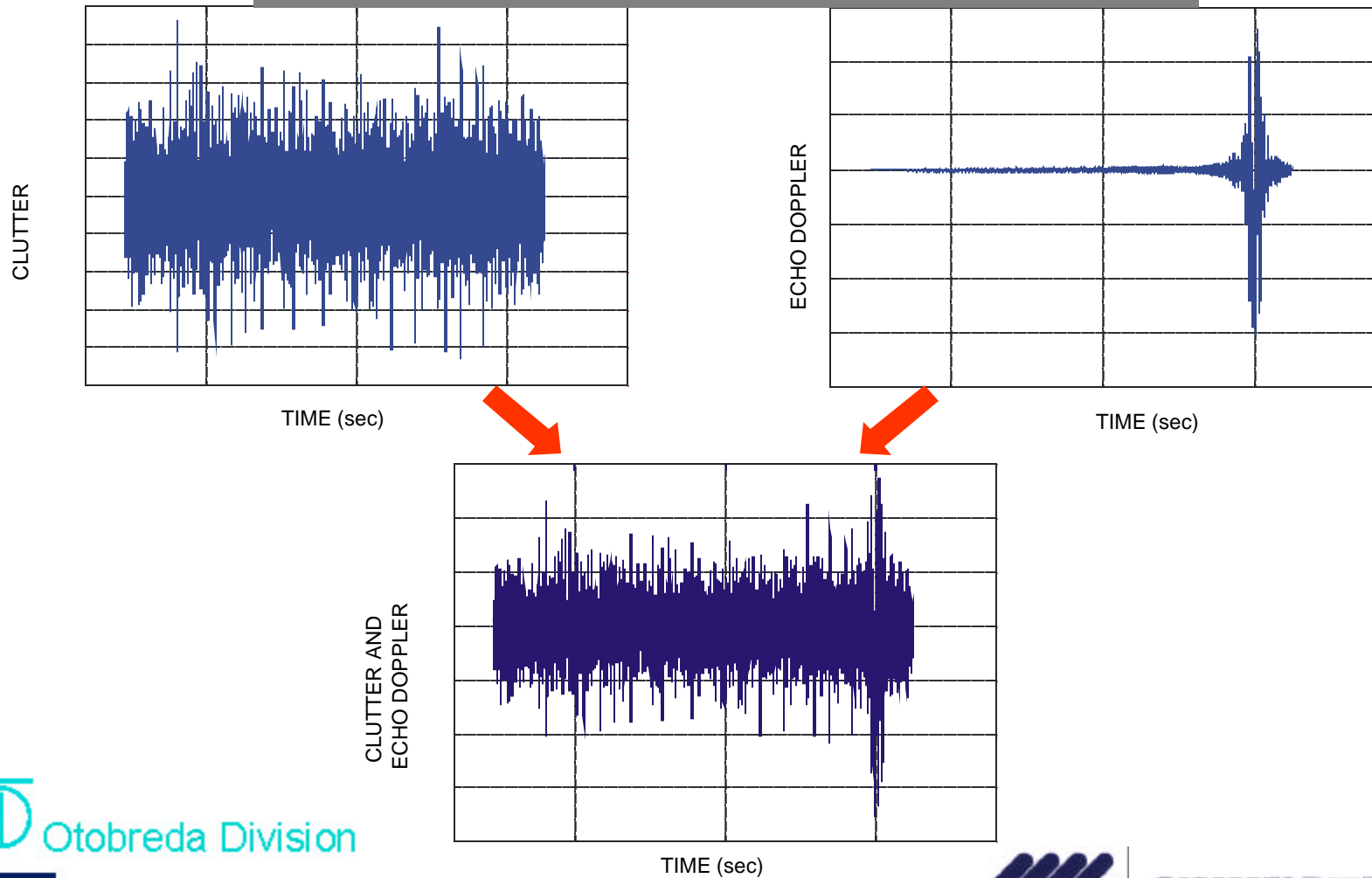


- BURST POINT OPTIMIZATION ACCOUNTING FOR MISS DISTANCE AND RELATIVE INTERCEPTION SPEED
- INSENSITIVE TO SEA CLUTTER
- ECM PROTECTION

## HIGH SENSITIVITY RADIUS

ACHIEVED BY

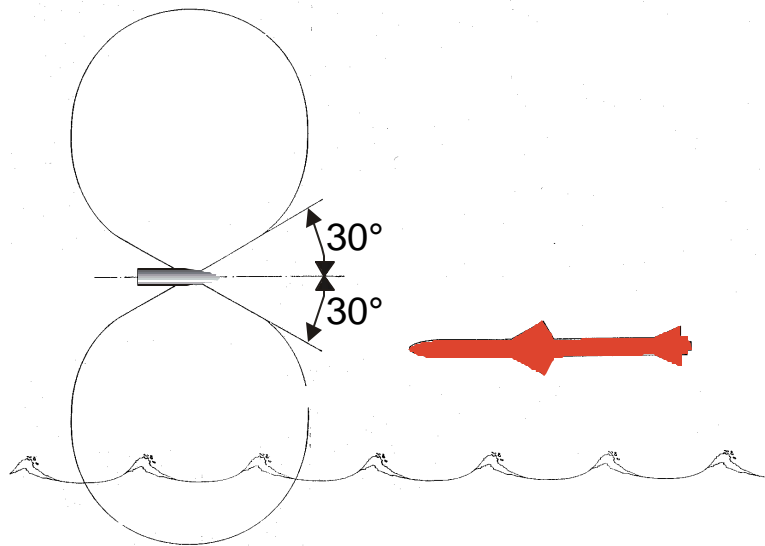
- LOW NOISE SENSOR
- HIGH COMPUTATION CAPABILITY DIGITAL SIGNAL PROCESSOR
- FFT AND PATTERN MATCHING ALGORITHMS



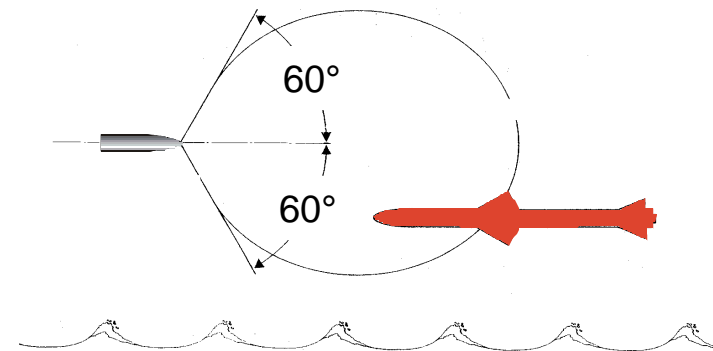
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# REJECTION OF SEA CLUTTER NOISE AND IMPROVEMENT TO TARGET DETECTION RANGE

## BODY ANTENNA FUZE



## NEW MICROWAVE FUZE



- INCREASE TARGET DETECTION RANGE
- REDUCE CLUTTER NOISE

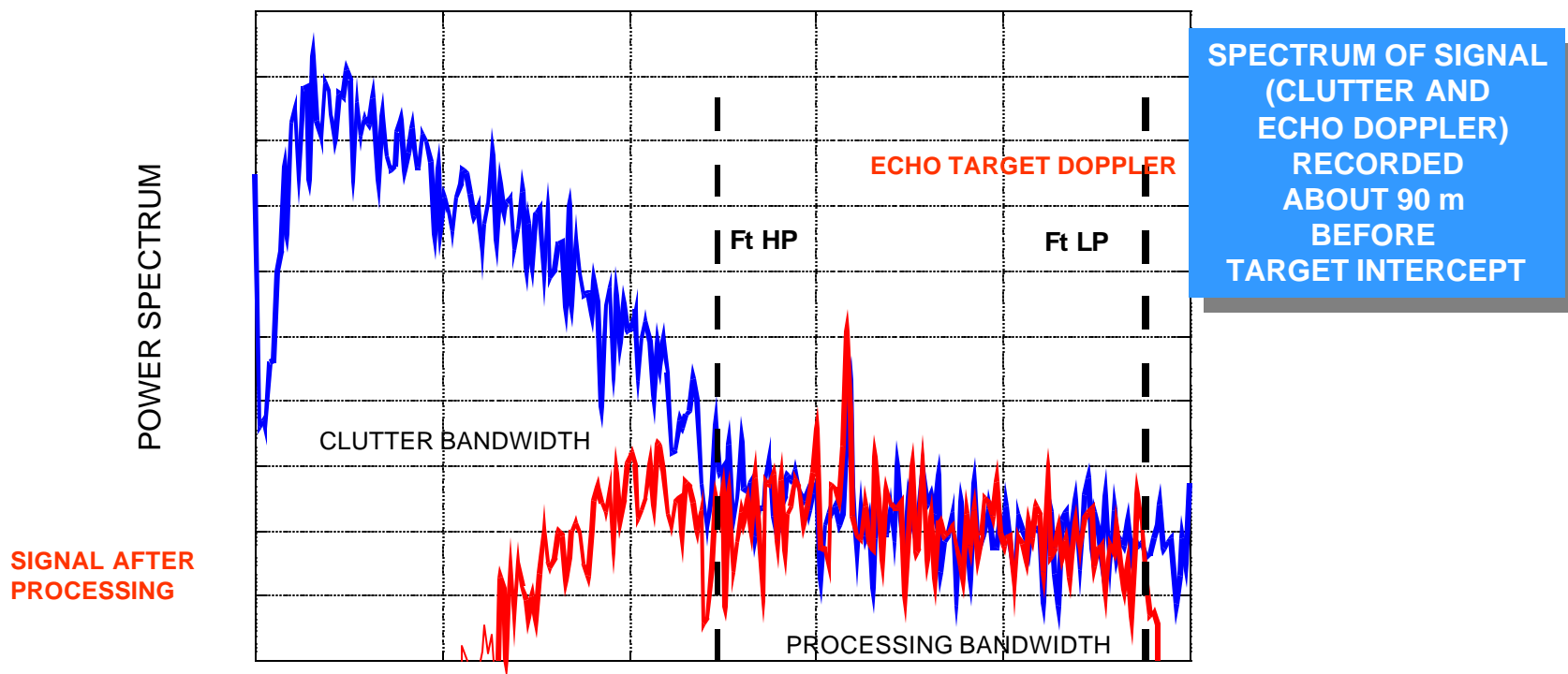


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## REJECTION OF SEA CLUTTER NOISE

ACHIEVED BY

- OPERATING NARROW BANDWIDTH ANALYSIS TO SEPARATE TARGET SIGNAL FROM CLUTTER NOISE
- INCREASING FUZE RF FREQUENCY TO INCREASE THE TARGET/CLUTTER SEPARATION



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## LOW SENSITIVITY TO EM ENVIROMENT

### ACHIEVED BY

- AN ELECTRONIC SETTER MOUNTED ON THE GUN WHICH ENABLES THE FUZE PROXIMITY MODE ONLY IN VICINITY OF TARGET
- USING NARROW BANDWIDTH SENSOR, ROBUST DIGITAL SIGNAL PROCESSING, ADVANCED SW LOGICS

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## PERFORMANCES IN PRIMARY ROLE

Primary Role	: ANTIMISSILE
Radial Sensitivity	: > 10 m
Action Probability	: > 95%
Level on sea	: down to 2 m

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# **IMPROVEMENTS TO THE “76/62 GUN BASED” SYSTEM**

## **COMPARISON BETWEEN NEW MICROWAVE FUZE AND BODY ANTENNA FUZES (SEA SKIMMING MISSILE)**

	MICROWAVE	BODY ANTENNA
RADIAL SENSITIVITY	> 10 m	3 m
TRIGGERING ACCURACY	1 m	2 m
DETONATION POINT OPTIMIZATION	ACCURATE (1)	COARSE
SEA CLUTTER REJECTION	VERY HIGH	MEDIUM
ECM PROTECTION	VERY HIGH	LIMITED

(1) Function of relative speed and miss distance

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## FIRING TEST AGAINST LOW ALTITUDE TARGET



TEST LOCATION:  
BALIPEDIO  
"COTTRAU"

LA SPEZIA  
15 JUNE 2000

*8 ROUNDS  
FIRED WITH  
MISS  
DISTANCES  
BETWEEN  
3 AND 6 m*

MOVIE SHOWING 8 FIRINGS

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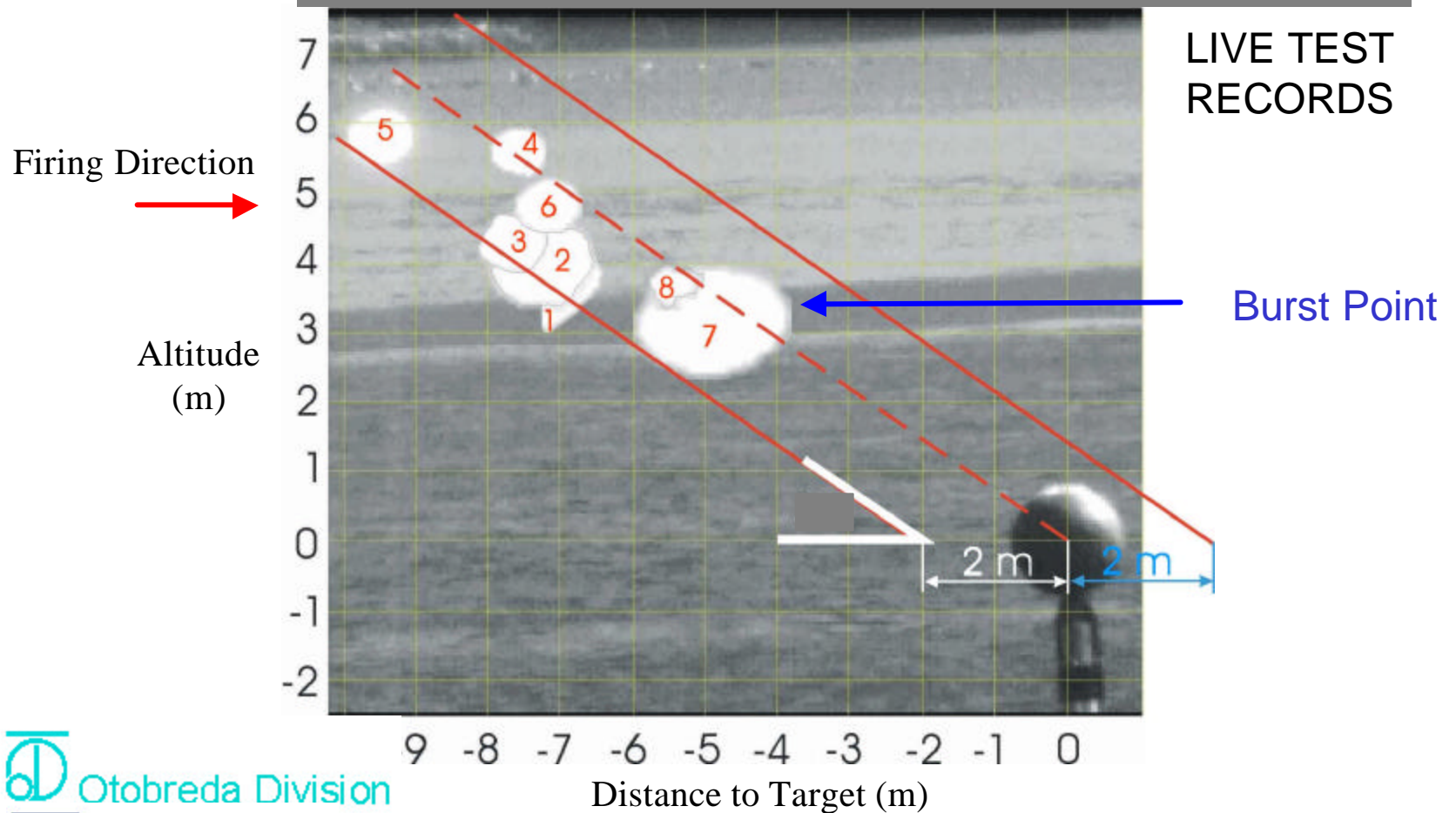


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# ACCURACY OF BURST POINT






ACHIEVED BY

- HIGH SPEED COMPUTATION FOR SIGNAL FREQUENCY ANALYSIS
- TRIGGER DECISION MADE BY ADVANCED SIGNAL PROCESSING INSTEAD OF TIME/AMPLITUDE ANALOG PROCESSING



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### DEVELOPMENT PROGRAM AND INDUSTRIALIZATION

Nr.	PHASE	96-97	1998	1999	2000	2001	2002	2003	2004
1	DEVELOPMENT								
2	INDUSTRIALIZATION AND QUALIFICATION								
3	EARLY DELIVERIES								

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